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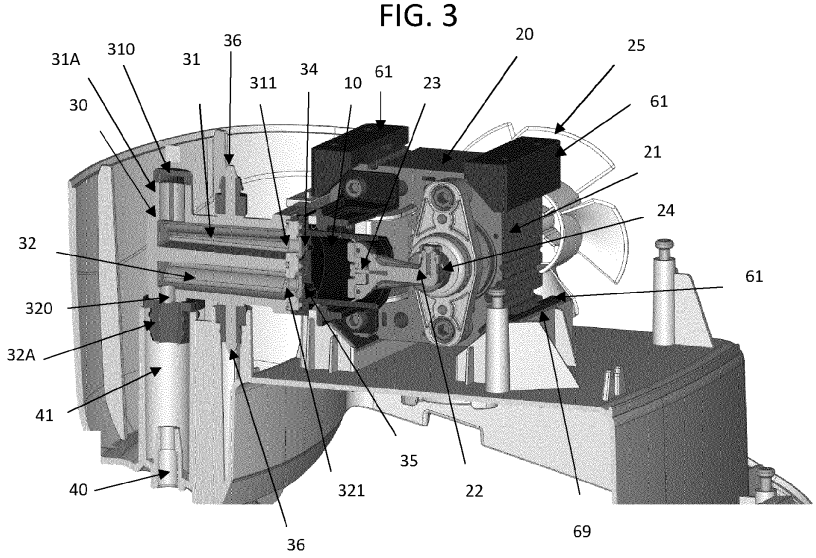
(54) **COMPRESSOR DEVICE FOR PROVIDING COMPRESSED AIR TO A MEDICAL DEVICE**

(57) The present invention concerns a compressor device (1) for providing compressed air to a medical device (100) comprising a casing (2) comprising a compression chamber (10), an electrically-driven compressor unit (20) for compressing air, and a manifold block (30) comprising an air admission line (31) for providing ambient air and a compressed-air distribution line (32) for conveying compressed-air. The manifold block (30) is firmly secured in a predetermined location in the casing (2). The compression chamber (10) and the electrically-driven compressor unit (20) can be arranged in several locations in the casing (2) with respect to the manifold block (30) so that the distance between the compression chamber (10) and the manifold block (30) is adjustable. Preferably, one or several spacers (50) are inserted between the compression chamber (10) and the manifold block (30).

FIG. 3



EP 4 206 467 A1

Description

[0001] The present invention concerns an improved medical compression device that can be used for providing pressurized gas, such as pressurized air, to a medical device using compressed gas, i.e. pressurized air.

[0002] Some medical devices need compressed air for working, such as nasal washing (i.e. cleaning) devices or the like.

[0003] Nasal washing (i.e. cleaning) devices are handheld devices that can be used for delivering a nebulized, aerosolized or atomized liquid solution, such as saline solutions or the like, to the nasal cavities of a person for promoting hydration and fluidification, thereby allowing removing excessive mucus and phlegm, i.e. catarrh, present in the nasal cavities and/or paranasal sinuses of the person and further preparing the nasal cavities and/or paranasal sinuses for subsequent administrations of therapeutic agents, drugs or the like.

[0004] Without such a "pre"-washing or "pre-"cleaning, the drugs or therapeutic agents that are subsequently intranasally administered, cannot act properly as they are stopped by the mucus and hence unable to reach the nasal areas, where they are supposed to act and/or to enter into the blood circulation of the person.

[0005] Nasal washing devices can be used with persons, especially pediatric users, such as babies, toddlers, infants or the like, suffering from various diseases, such as rhinopharyngitis, allergic rhinitis or chronic sinusitis, and subsequently treated by antihistaminic agents, antibiotics or decongestants that are intranasally delivered.

[0006] Examples of nasal washing devices are disclosed by EP-A-2732881 and EP-A-2274033.

[0007] The aerosolization, i.e. atomization/nebulization, of the liquid solution is obtained by means of compressed air provided by an external gas compression device, commonly called a compressor device or a compressor, that is fluidly connected to the medical device requiring compressed air for working, such as a nasal washing device by means of a flexible hose, as shown in Figure 1.

[0008] A compressor device usually comprises a compression unit driven by an electrical motor unit and cooperating with a compression chamber for sucking ambient air (i.e. air at atmospheric pressure) and providing compressed air (i.e. air at a pressure greater to atmospheric pressure) to a manifold block.

[0009] However, in known compressor devices, the compression unit, the electrical motor unit, the compression chamber and the manifold block are tightly coupled together, and arranged in fixed positions in the casing of the compressor device.

[0010] This is clearly a problem as when different pressures are needed, it might be necessary to change the position of the motor unit in the casing where it is installed.

[0011] However, this is not possible or easy to do, because many motor units are not detachable from compression units and/or their positioning in the casing can not be (easily) varied.

[0012] A goal of the present invention is to provide an improved compressor device that overcomes the above problem so that different compression pressures.

[0013] A solution according to the present invention is a compressor device for providing compressed air to a medical device, comprising a casing, i.e. the peripheral housing of the compressor, comprising a compression chamber; an electrically-driven compressor unit cooperating with the compression chamber for compressing air; and a manifold block comprising an air admission line for providing ambient air to the compression chamber and a compressed-air distribution line for conveying compressed-air provided by the compression chamber, and wherein the manifold block is firmly secured, i.e. held in place, in a predetermined location in the casing.

[0014] According to the invention, the compression chamber and the electrically-driven compressor unit can be arranged in several locations in the casing with respect to the manifold block so that the distance between the compression chamber and the manifold block is adjustable thereby controlling or adjusting the compression pressure.

[0015] A compressor device according to the present invention can comprise one or several of the following additional features :

- the compression chamber is in fluid communication with the air admission line and the compressed-air distribution line of the manifold block.
- a first one-way valve is arranged between an air outlet of the air admission line of the manifold block and an air inlet of the compression chamber, for prohibiting compressed-air to penetrate into the admission line.
- a second one-way valve is arranged between a compressed-air inlet of the compressed-air distribution line of the manifold block and a compressed-air outlet of the compression chamber for allowing compressed-air to pass only from the compression chamber to the compressed-air distribution line.
- the electrically-driven compressor unit comprises an electric motor driving a piston rod cooperating with a piston head, said piston head being mobile in the compression chamber.
- the air admission line of the manifold block is in fluid communication with atmospheric air, i.e. ambient air (at atmospheric pressure, i.e. 1 bar).
- the compressed-air distribution line of the manifold block is in fluid communication with a compressed-air outlet arranged on the casing.
- the compressed-air outlet is carried by a gas connector or the like.
- one or several spacers are inserted between the compression chamber and the manifold block for adjusting the distance between the compression chamber and the manifold block.

- each spacer comprises a main body traversed by at least one central passage, such as a large opening, forming a conduit portion for conveying air.
- the central passage of each spacer forms a conduit portion for conveying air, i.e. ambient air and compressed air, in its lumen.
- the central passage of each spacer is in fluid communication with the compression chamber, on the one hand, and with the air admission line and the compressed-air distribution line of the manifold block, on the second hand.
- each spacer comprises a main body having a flat shape, preferably a plate shape.
- each spacer comprises a main body having a square shape or any other suitable shape.
- the casing comprises two half-casings assembled together, especially screwed together.
- the two half-casings comprise an upper half-casing and a lower half-casing.
- the compressing elements are arranged in the upper half-casing.
- the casing is rigid.
- the casing is made of polymer, such as ABS, polypropylene (PP), polystyrene (PS) or polyamide (PA), such as Nylon®, or the like.
- the electrically-driven compressor unit cooperates with the compression chamber for compressing air above atmospheric pressure, i.e. > 1 bar, typically of between 1.1 and 4 bar, preferably up to 3 bar.
- the electrically-driven compressor unit comprises an electrical motor arranged in a peripheral housing.
- the electrically-driven compressor unit cooperates with the compression chamber for providing compressed-air at a maximum flowrate of less than about 15 L/min, preferably less than about 10 L/min, typically of 5 L/min or less.
- an electrical-power source provides electrical power to the electrically-driven compressor unit.
- the electrical-power source comprises one or several rechargeable batteries or the like, or the Mains (110/240V).
- the compressor device further comprises cradle elements sandwiching the peripheral housing of the motor so as to hold the electrically-driven compressor unit in place in a desired location.
- the cradle elements are lodged in cradle-holding structures arranged in the casing, such as lodgings or the like.
- each cradle element comprises an elongated cradle body configured for matching the outer contours of the housing of the motor.
- the cradle body comprises one or several angled portions forming an angle (α) of between about 90° to 165°.

[0016] The present invention will be explained in more details in the following illustrative description of an embodiment of a nasal washing/cleaning device according to the present invention, which is made in references to the accompanying drawings among them :

- Figure 1 shows a nasal washing device according to the prior art fluidly connected to a compressor device,
- Figure 2 is a side sectional view of the compressing elements and of part of the casing of a compressor device according to the present invention,
- Figure 3 is a 3/4 sectional view of the compressing elements and of part of the casing of Figure 2,
- Figure 4 is a 3/4 view of the compressing elements of Figures 2 and 3,
- Figure 5 shows the mounting of the compressing elements in the casing of a compressor device according to the present invention
- Figure 6 represents the compressing elements after their mounting in the casing of Figure 5,
- Figures 7 and 8 illustrate the assembly of the casing of a compressor device according to the present invention shown upside down,
- Figure 9 shows the compressor device according to the present invention,
- Figure 10 represent the cradle elements used for sandwiching of the housing of the motor, and
- Figure 11 shows an embodiment of a spacer.

[0017] Figure 1 shows a medical device 100 using compressed air, namely a nasal washing device comprising a main body, a reservoir for containing a liquid solution to be aerosolized, nebulization means for aerosolizing the liquid solution using compressed air, and a nasal interface with an exit orifice 102 for delivering the aerosolized solution for cleaning the nasal cavities of a user.

[0018] Compressed air is provided by a compressor device 1, i.e. an independent compressed-air generator, that is fluidly connected to the medical device 100, i.e. the nasal washing device, by means of a flexible hose 200 that is plugged, on the one hand, to a gas connector 40 (not visible) arranged on the compressor device 1 and, on the other hand, to a gas entry connector 101 of the medical device 100.

[0019] The compressor device 1 comprises a rigid casing or housing 2 containing in its inner volume 5, compressing elements 3 used for compressing ambient air (i.e. air at atmospheric pressure) and providing compressed-air to the medical device 100, namely the nasal washing device. A pivotable cover 4 arranged on the casing 2 gives access to the inner volume 5 of the casing 2.

[0020] Compressing elements 3 typically comprise an air compression chamber arranged between an electrically-driven compressor unit and a manifold block, and cooperating together for compressing air.

[0021] Ambient air sucked by the electrically-driven compressor unit, passes through the manifold block, then enters into the air compression chamber where it is compressed and, once compressed, exits the air compres-

sion chamber and is provided to the medical device 100, via the hose 200.

[0022] Figures 2 and 3 represent sectional views of an embodiment of the compressing elements 3 arranged in the casing 2 or housing of a compressor device 1 according to the present invention.

[0023] As shown in Fig. 8-10, the casing 2 is made of two half-casings 2A, 2B assembled together, namely an upper half-casing or hood 2A and a base or lower half-casing 2B. The compressing elements 3 are arranged in the hood 2A, i.e. the upper half-casing. The two half-casings 2A, 2B are fixed together by screws of the like.

[0024] The compressing elements 3 comprise a compression chamber 10, and an electrically-driven compressor unit 20 cooperating with the compression chamber 10 for compressing air provided by a manifold block 30.

[0025] The manifold block 30 comprises an air admission line 31, i.e. air passage, for providing ambient air to the compression chamber 10 and further a compressed-air distribution line 32, i.e. a pressurized air passage, for conveying compressed-air provided by the compression chamber 10. The admission line 31 and the distribution line 32 are parallelly arranged.

[0026] The air admission line 31 of the manifold block 30 comprises an air inlet 310 in fluid communication with the atmosphere and an air outlet 311 in fluid communication with the compression chamber 10. The air admission line 31 conveys air from the air inlet 310 to the air outlet 311. Air circulates into the lumen of the air admission line 31 thanks to the suction force provided by the electrically-driven compressor unit 20, as below explained.

[0027] Further, the distribution line 32 of the manifold block 30 comprises a compressed-air inlet 321 in fluid communication with the compression chamber 10 and a compressed-air outlet 320 for delivering compressed air. The distribution line 32 conveys the compressed air obtained in the compression chamber 10 towards the compressed-air outlet 320. The compressed-air outlet 320 of the manifold block 30 is in fluid communication with a gas connector 40, via a gas conduct 41. The gas connector 40 is configured for connecting the gas hose 200 thereto, as shown in Fig. 1.

[0028] The manifold block 30 can be made of a rigid material, such as polymer, for instance ABS, polystyrene (PS) or polyamide (PA), such as Nylon®, or the like.

[0029] Further, a first one-way valve 34 is arranged between an air outlet 321 of the air admission line 31 of the manifold block 30 and an air inlet 11 of the compression chamber 10. This first one-way valve 34 allows air coming from the admission line 31 to enter into the compression chamber 10 due to the suction force resulting from the functioning of the electrically-driven compressor unit 20, but not in the reverse way, i.e. compressed-air can not travel back into the admission line 31 as it is blocked by the first one-way valve 34 (i.e. no back flows).

[0030] Similarly, a second one-way valve 35 is arranged between a compressed-air inlet 321 of the compressed-air distribution line 32 of the manifold block 30 and a compressed-air outlet 12 of the compression chamber 10. This second one-way valve 35 allows compressed-air exiting the compression chamber 10 to enter into the distribution line 32, but blocks any gas travel in the reverse way, i.e. air present in the distribution line 32 can not travel backwards and re-enter into the compression chamber 10, due to the suction force generated by the electrically-driven compressor unit 20, as it is blocked by the second one-way valve 35.

[0031] The first and second one-way valves 34, 35 can be two separate flat planar valve elements having each a length of between about 5 and 15 mm in one direction/axis and of between about 5 and 15 mm in another direction/axis, such as perpendicular axis, and a thickness of between about 0,1 to 0,8 mm. They are preferably made of a soft polymeric material such as rubber or silicone. According to another embodiment, the first and second one-way valves 34, 35 can be two parts or portions of a same component, i.e. a unique valve element, having a disk shape (e.g. from 20 to 50 mm of diameter) or a square or rectangle shape (e.g. with sides of between 20 to 50 mm).

[0032] The compression chamber 10 is in fluid communication with the air admission line 31 and the compressed-air distribution line 32 of the manifold block 30. Further, the electrically-driven compressor unit 20 comprises compression means that cooperate with the compression chamber 10. More precisely, the compressor unit 20 comprises an electric motor 21 driving a piston rod 22 cooperating with a piston head 23. The piston head 23 and the piston rod 22 are mobile in (at least a part of) the compression chamber 10.

[0033] The back-and-forth motion of the piston head 23 into the compression chamber 10 involves a suction of ambient air provided by admission line 31, followed by a compression of said sucked air into the compression chamber 10. The compressed air thus obtained is evacuated by, i.e. pushed into, the distribution line 32 of the manifold block 30.

[0034] The piston rod 22 is driven by the rotatable axis 24 of the electrical motor 21. The electrical power required by the motor 21 or any other component of the device 1 that is electrically-driven, is provided by an electric source, such as a battery or an electrical outlet (110/240V), or both.

[0035] For instance, the motor 21 can be a DC motor (12 to 36 V). The compressor device 1 provides compressed-air at a maximum pressure of for instance 3 bar, typically of about 1.1 bar to 4 bar, and at a maximum flowrate of 15 L/min, preferably of between 5 and 15 L/min, or less.

[0036] A rotating fan 25, also driven by the motor 21, is provided for cooling the motor 21 and other inner components that are heated while the compressor device 1 is working.

[0037] As shown in Fig. 4-6, the manifold block 30 fur-

ther comprises first connection means cooperating with second connection means of the casing 2 for firmly fixing and maintaining the manifold block 30 in a specific location or spot inside the casing 2.

[0038] In the embodiment shown, the first and second connection means comprise a male/female connection system 36, 26 comprising protruding elements 36, like fingers, elongated parts or the like, carried by the manifold block 30, i.e. by its peripheral wall, that are configured for being insertable into lodgings 26 arranged inside the casing 2, for instance carried by the inner wall(s) of the casing 2.

[0039] Preferably, in order to avoid or limit vibrations or the like, the protruding elements 36 are equipped with mufflers 60 made of a flexible or resilient material, such as rubber, silicon or elastomeric material, such as Viton®. The mufflers 60 can have a general tubular or annular shape as shown in Fig. 4-6.

[0040] Similar mufflers 60 can also be arranged, as shown in Fig. 4, around the upstream portion 31A of the admission line 31 that comprises the air inlet 310 and further around the downstream portion 32A of the distribution line 32 that comprises the compressed-air outlet 320 for the same purposes, namely prohibiting, avoiding or limiting vibrations that may exist while the compressor device 1 is working.

[0041] According to the present invention, the compression chamber 10 and the electrically-driven compressor unit 20 are arranged to be moveable between different locations, i.e. fixed in several locations, in the casing 2 with respect to the manifold block 30 that is fixed (and not moveable to other locations).

[0042] Changing the positioning of between the compression chamber 10 (and compressor unit 20) with respect to the manifold block 30, i.e. adjusting the distance in-between, renders possible a variation of the compression force/level of the compressor device 1.

[0043] Indeed, the maximum and minimum pressure values, i.e. the pressure range, that can be obtained thanks to air compression in the compression chamber 10, depends on the distance between the piston assembly 22, 23 (i.e., piston rod 22 and piston head 23) and the manifold block 30. If the piston assembly 22, 23 moves closer to the manifold block 30, then the pressure that is thus generated increases whereas, conversely, it decreases when they are more distant. Indeed, the volume of air that can be compressed is lower, when those parts are closer, so that air is more compressed leading to an increased pressure, and vice versa.

[0044] Adding one or more spacers 50 between the manifold block 30 and the compression chamber 10 (and compressor unit 20) allows varying said distance thereby obtaining desired pressure values, i.e. the compression level.

[0045] In other words, one or several spacers 50 are inserted, i.e. sandwiched, between the compression chamber 10 and the manifold block 30 as illustrated in Fig. 5-7, for compensating the change of location of the assembly formed by the compression chamber 10 and the electrically-driven compressor unit 20, while ensuring an efficient compression of air.

[0046] As shown in Fig. 11, each spacer 50 comprises a main body 51 traversed by (at least one) a central passage 52, i.e. a large opening, forming a conduit portion for conveying air, i.e. ambient air and compressed air, in its lumen. The main body 51 of each spacer 50 can have a flat shape, such as a plate or the like, having for instance a thickness of between about 0,5 and 3 mm. In the embodiment of Fig. 11, the spacer 50 has a flat square shape.

[0047] Further, each spacer 50 comprises mounting holes 53 or the like that can receive fixation screws (not shown) or the like. Preferably, four holes 53 arranged in its four corners.

[0048] The spacers 50 can be made of any suitable rigid polymeric material, such as ABS, polypropylene (PP) or polyamide (PA), for instance Nylon®.

[0049] Preferably, several spacers 50 are used. They are juxtaposed, i.e., arranged side by side. The pressure of compressed air varies upon the number of spacers 50 used. Thus, increasing the number of spacers 50 results in a decrease of output air pressure, and vice versa. For instance, using from 1 to 3 spacers 50 allows delivering a pressure of about 0,5 to 5 bar.

[0050] Furthermore, as the use of spacers 50 involves a slight change of location and orientation of the compression chamber 10 and of the electrically-driven compressor unit 20, it is necessary to take said variations of location and orientation into account by using cradle elements 61 that can be held by cradle-holding structures 69 arranged in the casing 2, such as cradle lodgings or the like, as shown in Fig. 3, 5 and 6.

[0051] As shown in Fig. 10, each cradle element 61 comprises an elongated cradle body 62 configured 63 for matching the outer contours of the housing 21a of the motor 21. In particular, the cradle body 62 comprises one or several angled portions 64 forming an angle (α) of between about 90° to 165°.

[0052] Preferably, several cradle elements 61 are used, more preferably four cradle elements 61 arranged face to face by pairs as shown in Fig. 5 so that each pair of cradles element 61 acts as jaws or clamps that "sandwich" the motor housing 21a and hold it still in the desired location.

[0053] As shown in Fig. 5, two cradle elements 61 are lodged in cradle-holding structures 69 arranged in the inner wall of the upper half-casing or hood 2a. These two cradle elements 61 receive the top part, i.e. roof, of the motor housing 21a, in particular at least two corner edges of the motor housing 21a.

[0054] Further, two other cradle elements 61 are in contact with the lower part, i.e. the base portion, of the motor housing 21a, in particular at least two corner edges of the motor housing 21a. Preferably, these two other cradle elements 61 are lodged in cradle-holding structures 69 arranged in the base or lower half-casing 2B.

[0055] Thanks to the angle (α) of the angled portions 64 of each cradle elements 61, it is possible to compensate the change of location of the motor assembly 20, including the motor housing 21a, with respect to the manifold block 30 due to the insertion of the spacers 50, when said motor assembly 20, especially the motor housing 21a, is lodged and maintained in said cradle elements 61.

[0056] Using such the cradle elements 61 allows adjusting or changing the location of the motor 21 in the casing 2, i.e. slightly moving forward or backward the electrically-driven compressor unit 20 for varying the compression of air.

[0057] Preferably, the cradle elements 61 are made of resilient material, such as rubber or silicone.

[0058] Figures 7 and 8 show the assembly of the casing 2 of a compressor device 1 according to the present invention, represented upside down. As one can see, the compressing elements 10, 20, 30 and spacers 50 are first mounted, e.g.screwed, in the hood 2A, i.e. the upper half-casing, of the casing 2, and then the two half-casings 2A, 2B are fixed together.

[0059] Figure 9 shows the compressor device 1 in its ready to use state. It can be used for providing pressurized gas, typically compressed air, to a medical device requiring such a compressed gas for working, such as a nasal washing or cleaning device useable for delivering an aerosolized washing/cleaning solution, such as a saline solution or the like, to the nasal cavities and/or paranasal sinuses of a person, as shown in Figure 1.

Claims

1. Compressor device (1) for providing compressed air to a medical device (100) comprising a casing (2) comprising :

   - a compression chamber (10),
   - an electrically-driven compressor unit (20) cooperating with the compression chamber (10) for compressing air, and
   - a manifold block (30) comprising an air admission line (31) for providing ambient air to the compression chamber (10) and a compressed-air distribution line (32) for conveying compressed-air provided by the compression chamber (10),

   and wherein the manifold block (30) is firmly secured in a predetermined location in the casing (2),

   characterized in that the compression chamber (10) and the electrically-driven compressor unit (20) can be arranged in several locations in the casing (2) with respect to the manifold block (30) so that the distance between the compression chamber (10) and the manifold block (30) is adjustable.

2. Compressor device according to claim 1, **characterized in that** the compression chamber (10) is in fluid communication with the air admission line (31) and the compressed-air distribution line (32) of the manifold block (30).

3. Compressor device according to claims 1 or 2, **characterized in that**:

   - a first one-way valve (34) is arranged between an air outlet (311) of the air admission line (31) of the manifold block (30) and an air inlet (11) of the compression chamber (10), for prohibiting compressed-air to penetrate into the admission line (31), and
   - a second one-way valve (35) is arranged between a compressed-air inlet (321) of the compressed-air distribution line (32) of the manifold block (30) and a compressed-air oulet (12) of the compression chamber (10) for allowing compressed-air to pass only from the compression chamber (10) to the compressed-air distribution line (32).

4. Compressor device according to claim 1, **characterized in that** the casing (2) comprises two half-casings (2A, 2B) assembled together.

5. Compressor device according to anyone of the preceding claims, **characterized in that** the electrically-driven compressor unit (20) comprises an electric motor (21) driving a piston rod (22) cooperating with a piston head (23), said piston head (23) being mobile in the compression chamber (10).

6. Compressor device according to anyone of the preceding claims, **characterized in that** the air admission line (31) of the manifold block (30) is in fluid communication with atmospheric air and the compressed-air distribution line (32) of the manifold block (30) is in fluid communication with a compressed-air outlet (320) arranged on the casing (2), preferably the compressed-air outlet (320) is carried by a gas connector (40).

7. Compressor device according to claim 1, **characterized in that** one or several spacers (50) are inserted between the compression chamber (10) and the manifold block (30) for adjusting the distance between the compression chamber (10) and the manifold block (30).

8. Compressor device according to claim 7, **characterized in that** each spacer (50) comprises a main body (51) traversed by at least one central passage (52) forming a conduit portion for conveying air.

9. Compressor device according to claims 6 or 7, **char-**

acterized in that each spacer (50) comprises a main body (51) having a flat shape, preferably a plate shape.

10. Compressor device according to claim 8, **characterized in that** the central passage (52) of each spacer (50) is in fluid communication with the compression chamber (10) and with the air admission line (31) and the compressed-air distribution line (32) of the manifold block (30).

11. Compressor device according to claim 1, **characterized in that** the motor (21) comprises a peripheral housing (21a).

12. Compressor device according to claims 1 and 11, **characterized in that** it further comprises cradle elements (61) sandwiching the housing (21a) of the motor (21) so as to hold the electrically-driven compressor unit (20) still in a desired location.

13. Compressor device according to claim 12, **characterized in that** the cradle elements (61) are lodged in cradle-holding structures (69) arranged in the casing (2).

14. Compressor device according to claims 12 or 13, **characterized in that** each cradle element (61) comprises an ellongated cradle body (62) configured (63) for matching the outer contours of the housing (21a) of the motor (21).

15. Compressor device according to claim 14, **characterized in that** the cradle body (62) comprises one or several angled portions (64) forming an angle (α) of between about 90° to 165°.

FIG. 1

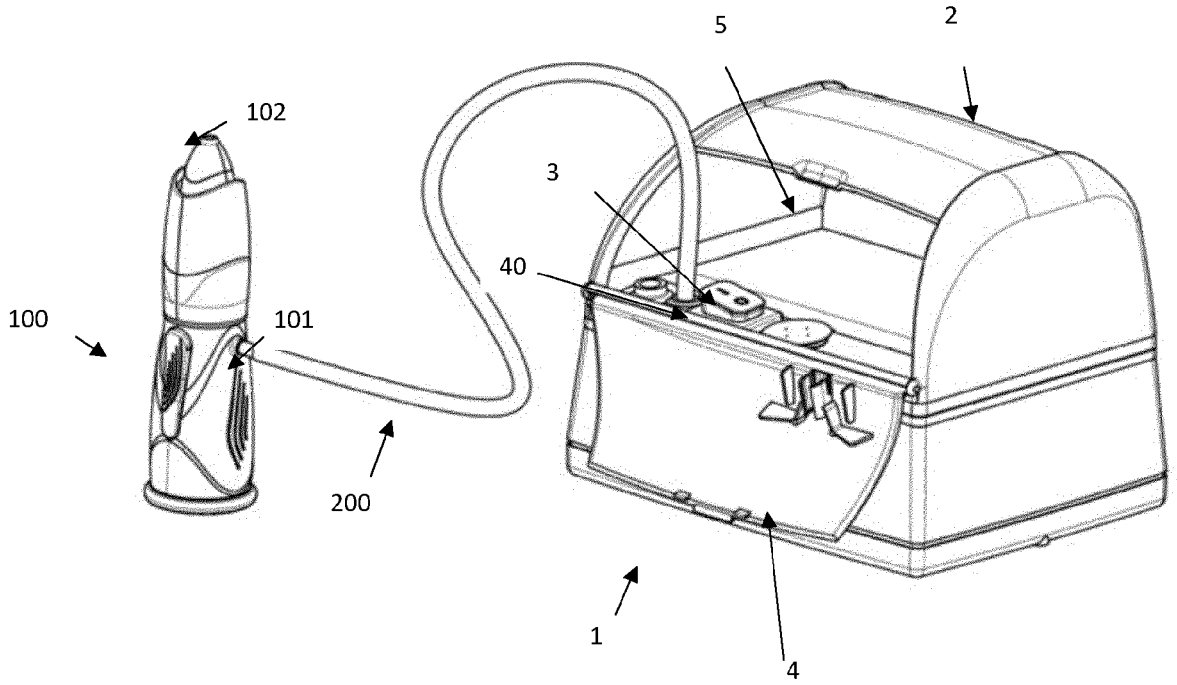

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FIG. 2

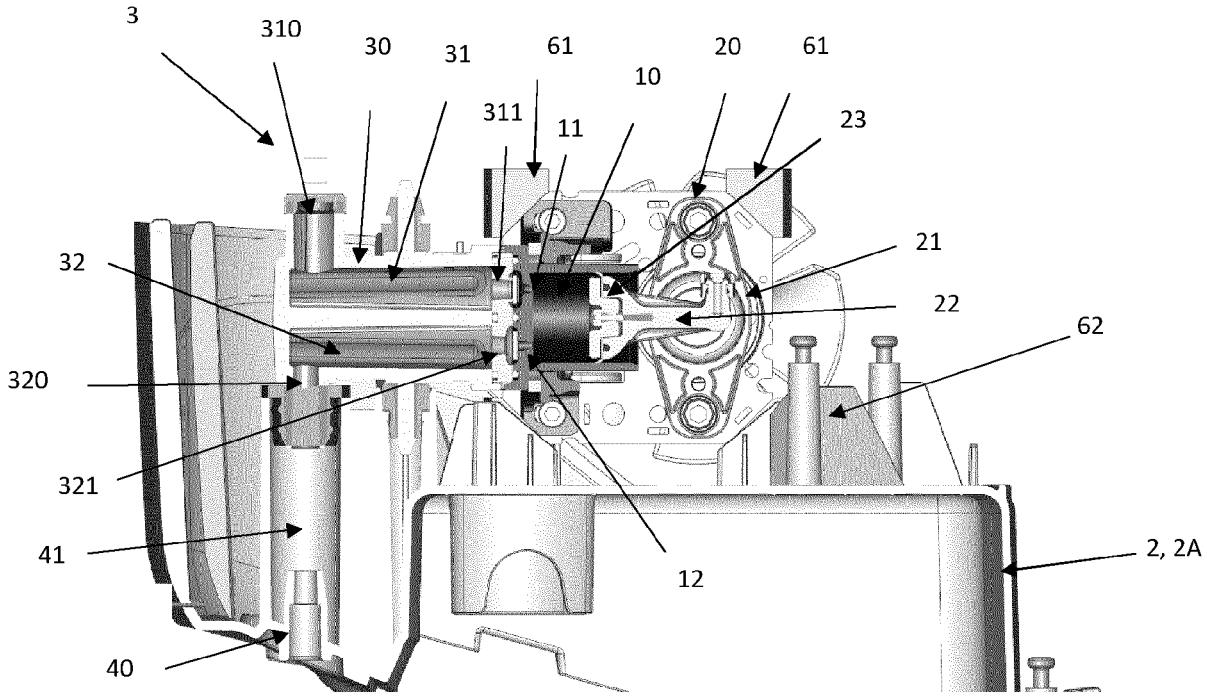
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FIG. 3

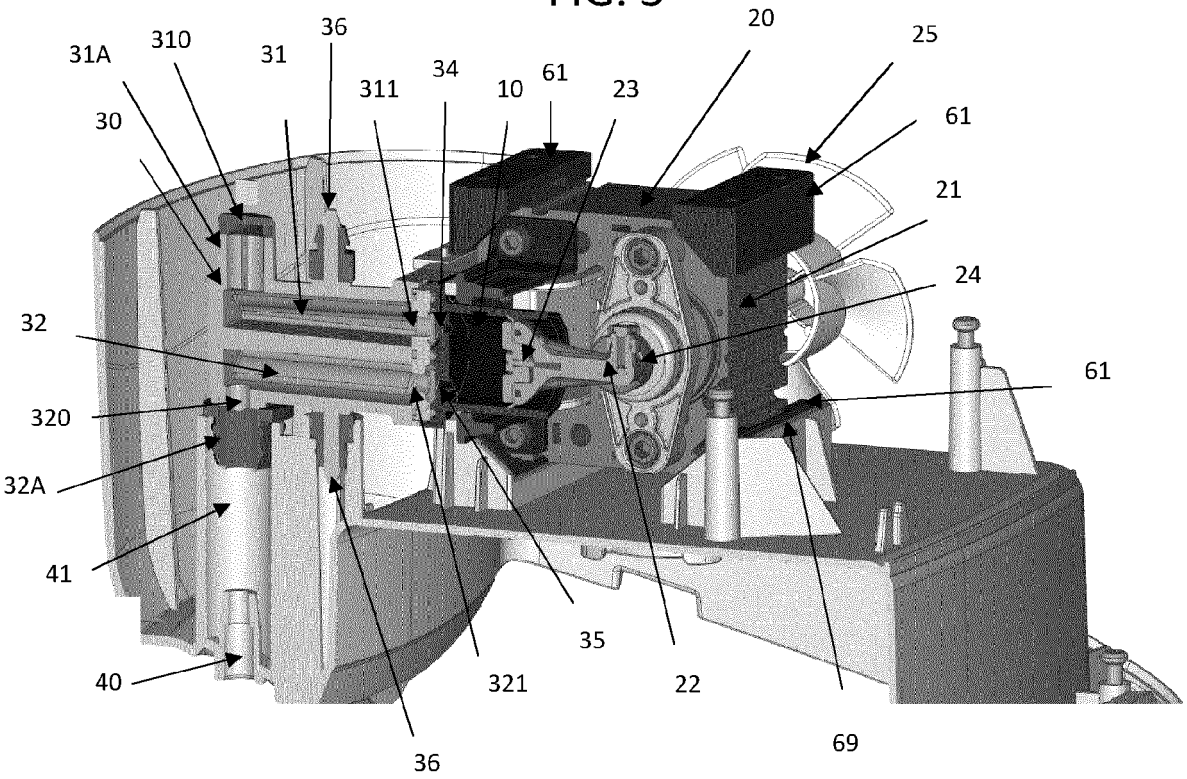
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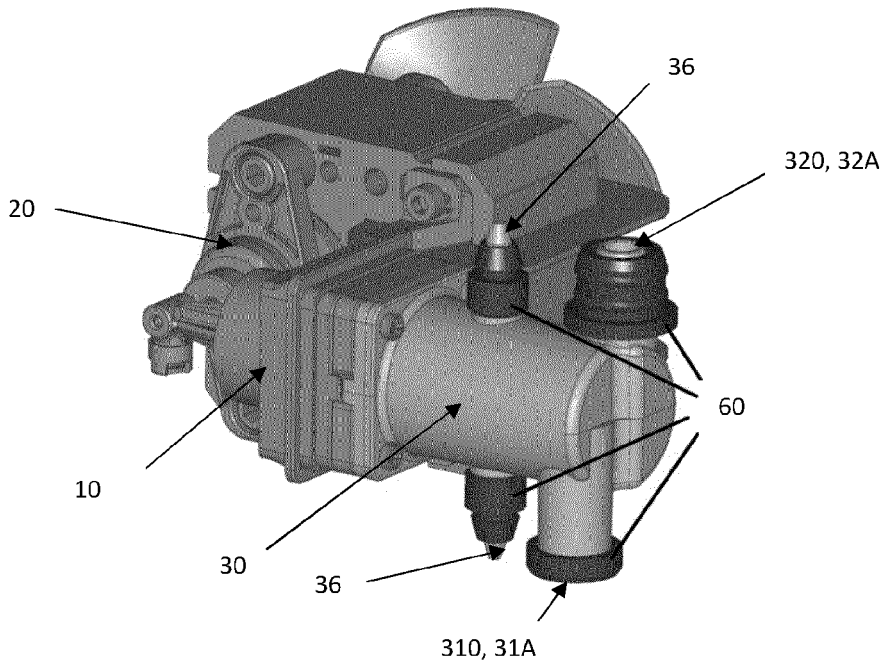
FIG. 4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310, 31A

FIG. 5

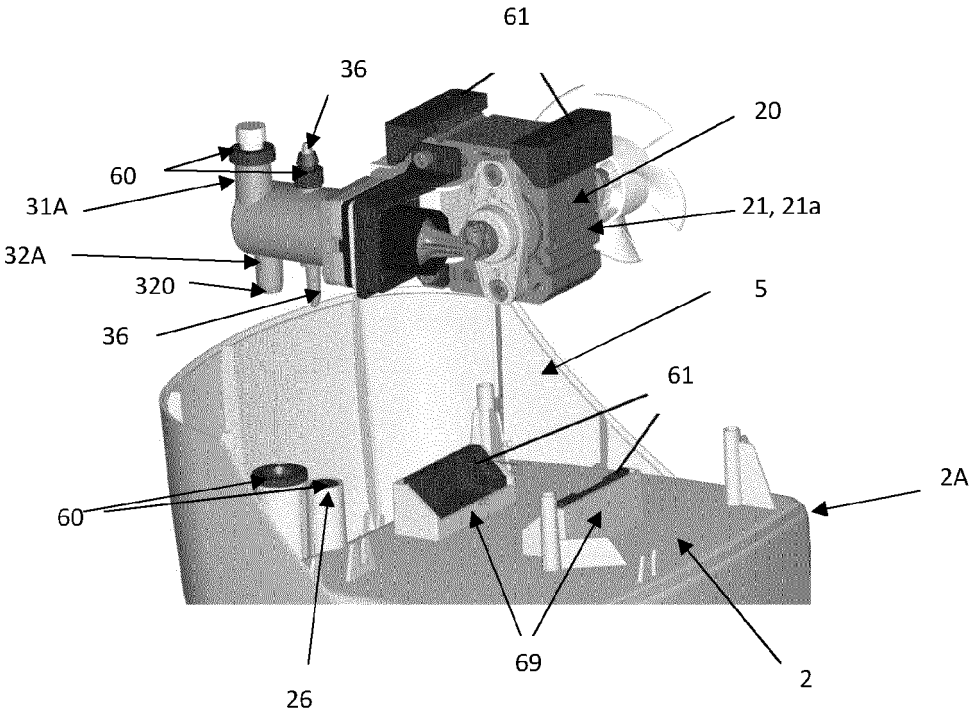

61
36
20
60
31A
21, 21a
32A
320
5
36
61
2A
60
69
2
26

FIG. 6

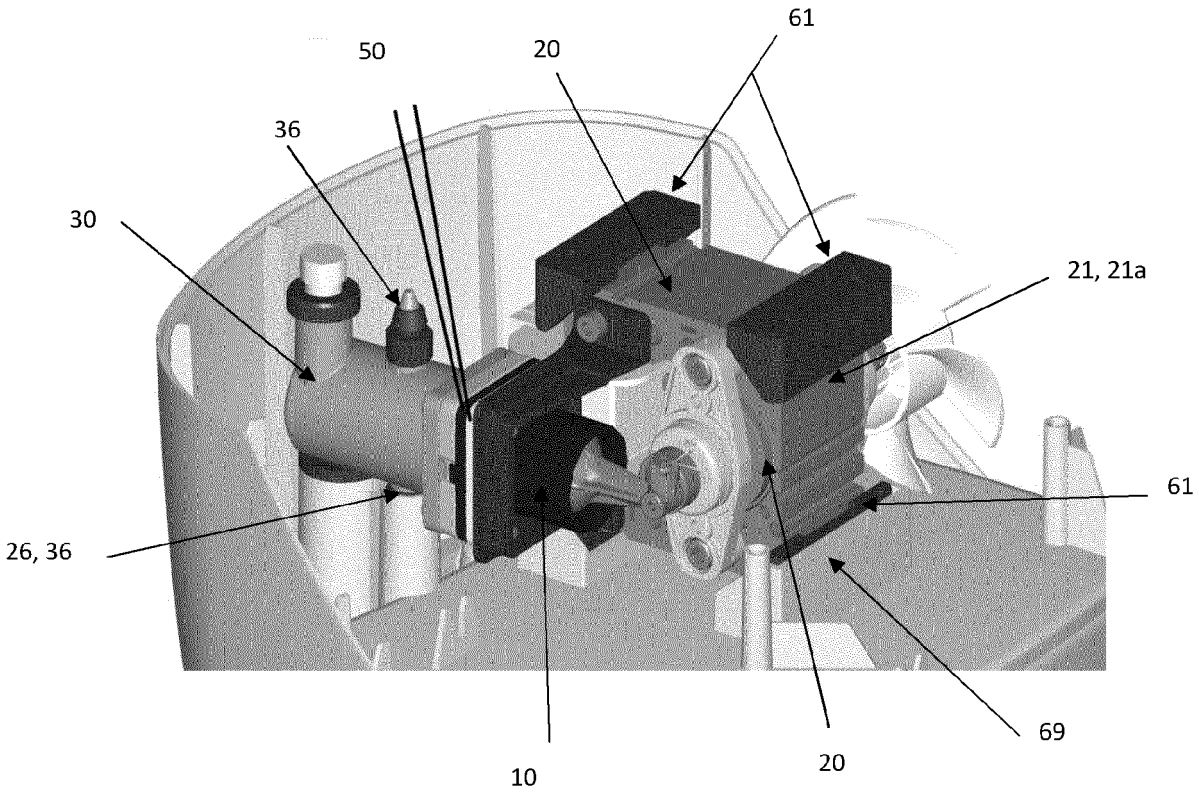

61
50
20
36
30
21, 21a
61
26, 36
69
10
20

FIG. 7

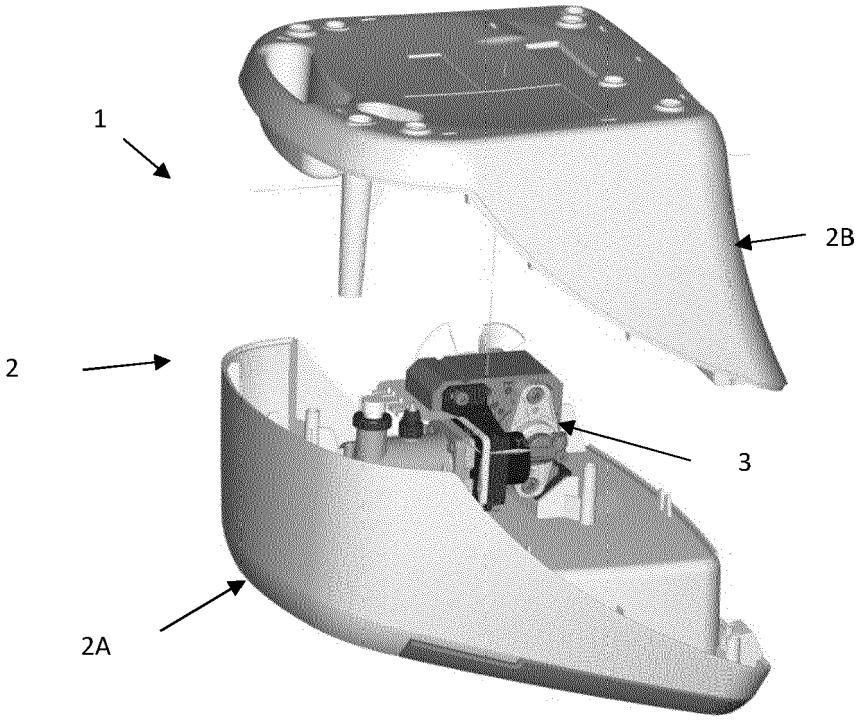


FIG. 8

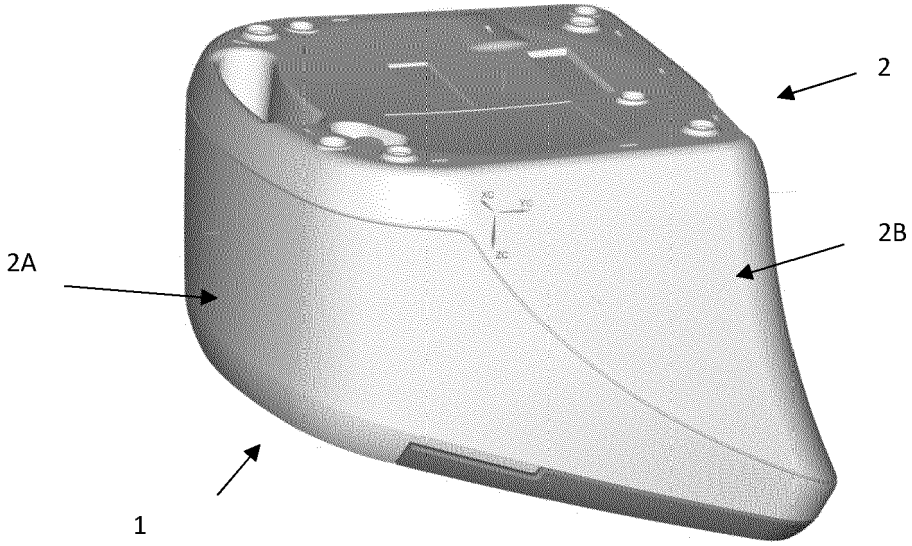


FIG. 9

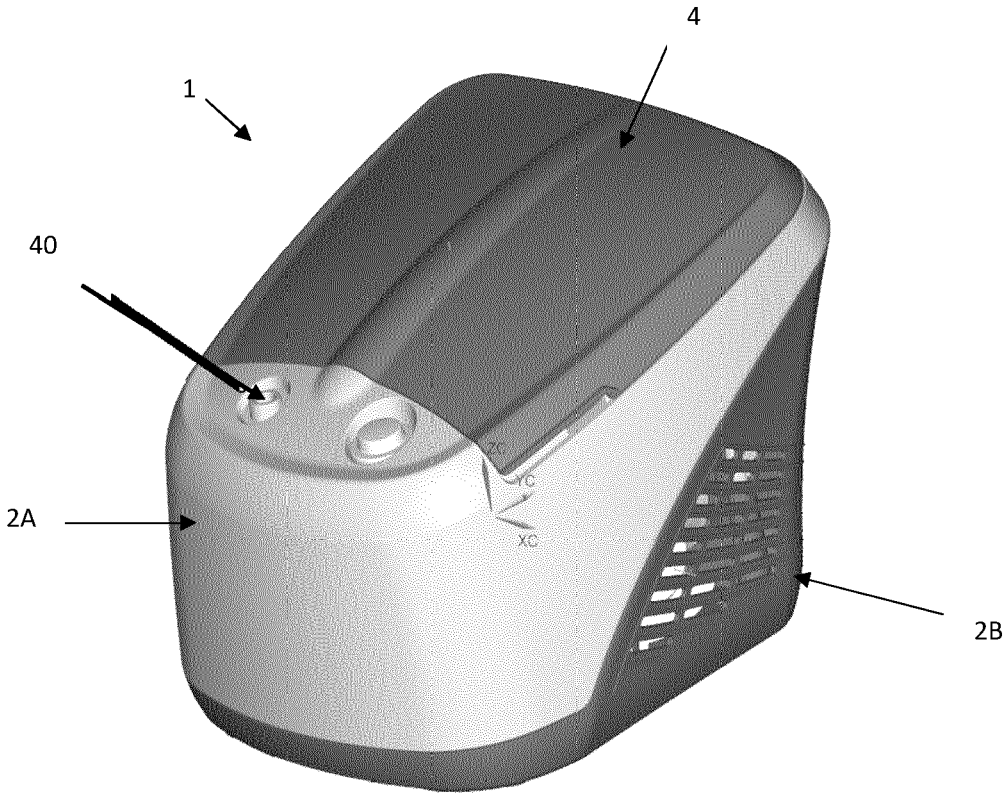


FIG. 10

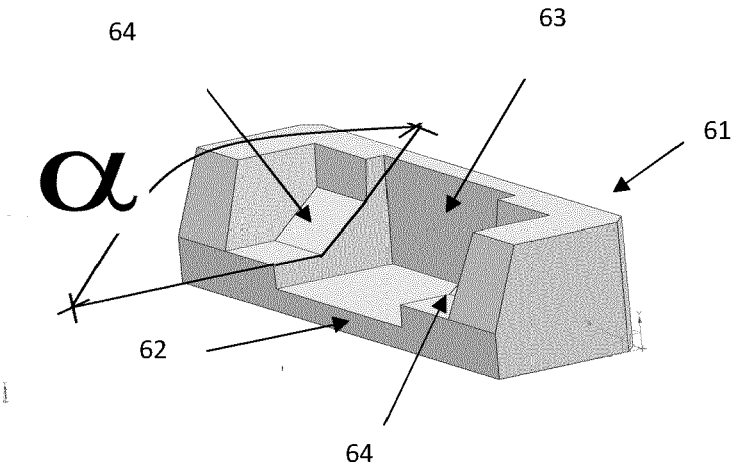
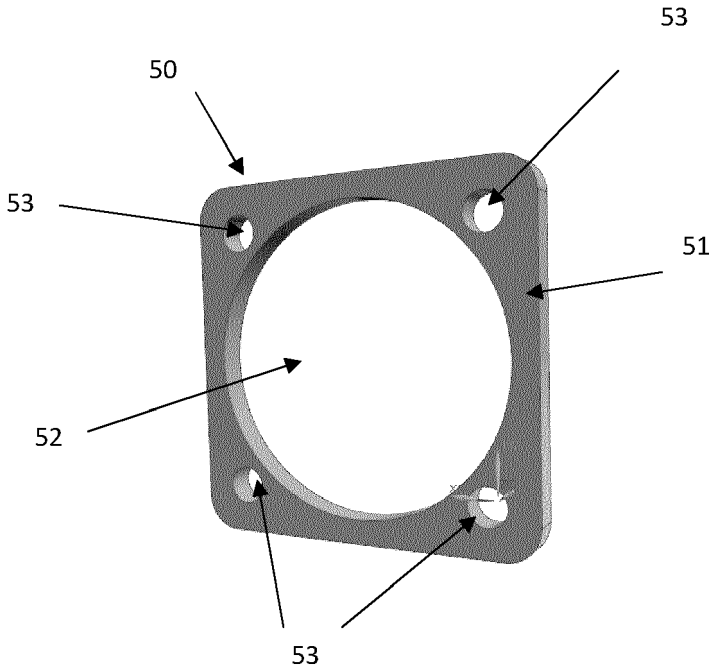


FIG. 11



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Place of search	Date of completion of the search	Examiner
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